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(54) LAMINATED POLYSTYRENIC FILM

(57)Abstract:

PURPOSE: To provide an aluminum oxide/silicon oxide gas barrier film excellent in retort resistance, bending resistance and gas barrier properties as a wrapping film.

CONSTITUTION: In a gas barrier film wherein an aluminum oxid/silicon oxide membrane is formed on a film composed of a resin compsn. containing a polystyrenic polymer having a syndiotactic structure, the ratio of aluminum oxide in the membrane is set to 20-99wt.% and the relation between the specific gravity of the membrane and the compositional ratio of aluminum oxide in the membrane is represented by a relational expressed D=0.01A+b (wherein D is the specific gravity of the membrane and A is the wt.% of aluminum oxide in the membrane). By setting the specific gravity of the membrane to the range of $1.6 \leq b \leq 2.2$, a transparent gas barrier film excellent in gas barrier properties, enhanced in retort resistance and bending properties and generally excellent in ractical characteristics can be provided.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application]This invention relates to a lamination syndiotactic polystyrene system film with the characteristic outstanding as the wrapping of which the airtightness of foodstuffs excellent in gas barrier property, retort-proof nature, and the GERUBO characteristic, drugs, electronic parts, etc. is required, or a gas cutoff material.
[0002]
[Description of the Prior Art]A polystyrene system polymer with syndiotactic structure is developed, and it is known that it is the raw material which was excellent in heat resistance or solvent resistance with the outstanding crystallinity. (JP,3-7685,B). development of the oriented film using these is also performed (JP,1-110122,A.) 1-168709, 1-182346, 2-279731, and the 3-74437 An item, 3-109453, and the 3-99828 An item, 3-124427, 3-131644. These syndiotactic polystyrene system film is excellent in electrical properties, such as a mechanical characteristic, transparency, chemical resistance, dielectric loss, and a dielectric constant, and being developed by the film for various industrial use and a package is expected. However, there was a problem said that a syndiotactic polystyrene system film has poor gas barrier property. As a film which was excellent in gas barrier property, what laminated aluminum on the plastic film, and the thing which coated the vinylidene chloride and the ethylene vinyl alcohol copolymer are known. As a thing using an inorganic thin film, what laminated oxidized silicon, an aluminum oxide thin film, etc. is known.
[0003]
[Problem(s) to be Solved by the Invention]When a polyester system film and a polyamide system film were used as a base film of a gas barrier property film, there was a problem of generating hydrolysis in the bottom of high-humidity/temperature or high-temperature-hot-water Nakashita. In order that a film might carry out humidity expansion under such environment, when it generated curl or the repetition environmental variation arose, there was a case where an inorganic thin film layer etc. generated exfoliation and cracked skin, and gas barrier property fell.
[0004]The conventional gas barrier property film had the following technical problems. Although an aluminum laminated piece is what was excellent in economical efficiency and gas barrier property, since the contents at the time of a package do not appear since it is opaque, and microwave is not penetrated, use of a microwave oven cannot be performed. What coated the vinylidene chloride and the ethylene vinyl alcohol copolymer does not have enough gas barrier property, such as a steam and oxygen, and the fall is

remarkable in especially high temperature processing. About the vinylidene chloride system, there are generating of the gaseous chlorine at the time of incineration etc., and we are anxious also about the influence on earth environment. On the other hand, although contents appear and the gas barrier film which vapor-deposited Si_xO_y (for example, SiO_2) on the synthetic resin body surface at JP,51-48511,B is proposed as a gas barrier film which can use a microwave oven, The SiO_x system with good gas barrier property (x= 1.3-1.8) has brown a little, and is insufficient as a transparent gas barrier film.

[0005]Although there are some which are seen by (JP,62-101428,A) as what made the aluminum oxide the subject, oxygen barrier property is insufficient and there is also a problem of flexibility. Although there are some which are proposed by (JP,2-194944,A) as an example of $aluminum_2O_3$ and a SiO_2 system as a gas barrier film which has retort nature, $aluminum_2O_3$ and SiO_2 are laminated and a device will become large-scale. The gas barrier characteristic and flexibility are still insufficient also about these thin film system gas barrier films. Namely, in order to raise flexibility to the thickness of the above (for example, 2000A) thin film being required to some extent in order to have retort-proof nature, It has the problem that the thinner possible one is good, and what is used as an object for the present retorts requires cautions for the handling. Thus, the actual condition is that combine sufficient oxygen barrier property and steam barrier property, have a retort-proof, and there is no high transparent gas barrier film of flexibility.

[0006]

[Means for Solving the Problem]This invention is excellent in gas barrier property and retort-proof nature, and uses high aluminum oxide and silicon oxide system gas barrier film of flexibility as an offer plug. Namely, in a gas barrier property film by which an aluminum oxide and a silicon oxide thin film were formed on a film which consists of a resin composition in which this invention contains a polystyrene system polymer which has syndiotactic structure, A ratio of an aluminum oxide is 99 or less % of the weight of 20 % of the weight or more in this thin film, When relation between specific gravity of this thin film and aluminum oxide composition ratio in a thin film is expressed with an expression of relations called D=0.01 A+b (D: specific gravity of a thin film, weight [of an aluminum oxide in A:thin film] %), A lamination polystyrene system film, wherein there is specific gravity of this thin film within limits decided by 1.6<=b<=2.2.

[0007]Tacticity used for this invention a polystyrene system polymer which is syndiotactic structure, It is desirable for tacticity by which a phenyl group or a substituted phenyl group which is a side chain is quantified with a nuclear magnetic resonance method to be not less than 50% of syndiotactic structure at die ADDO (a constitutional unit is two pieces) in not less than 85% and a pentad (a constitutional unit is five pieces). As this polystyrene system polymer, polystyrene, poly (p-, m-, or o-methylstyrene), Poly (2,4-, 2,5-, 3,4-, or 3,5-dimethylstyrene), Poly, such as poly (p-tertiary-butylstyrene) (alkyl styrene), Poly (p-, m-, or o-chlorostyrene), poly (p-, m-, or o-bromostyrene), Poly, such as poly (p-, m-, or o-fluorostyrene) and poly (o-methyl-p- fluorostyrene) (halogenation styrene), Poly, such as poly (p-, m-, or o-chloromethyl styrene) (halogenation alkyl styrene), Poly, such as poly (p-, m-, or o-methoxy styrene) and poly (p-, m-, or o-ethoxystyrene) (alkoxy styrene), Poly, such as poly(carboxy alkyl styrene) poly (p-vinylbenzyl propyl ether), such as poly (p-, m-, or o-carboxymethylstyrene) (alkyl ether styrene), poly (alkyl silylstyrene), such as poly (p-trimethylsilyl styrene), -- poly (vinylbenzyl dimethoxyphosphide) etc. are mentioned further.

Especially in this invention, polystyrene is preferred in said polystyrene system polymer. A polystyrene system polymer which has the syndiotactic structure used by this invention, It is not necessary to be necessarily a single compound, and as long as syndiotacticity is said within the limits, a mixture, and copolymers and those mixtures with a polystyrene system polymer of atactic structure or isotactic structure may be sufficient.

[0008]Weight average molecular weight of a polystyrene system polymer used for this invention is 50,000 or more still more preferably 10,000 or more. Weight average molecular weight cannot obtain a film excellent in the strong ductility characteristic or heat resistance in less than 10,000 thing. Although not limited in particular for a maximum of weight average molecular weight, since generating of a fracture accompanying increase of extension tension, etc. arise, it is not so desirable at 1500 or 000 or more.

[0009]To a polystyrene system polymer used for this invention, electrostatic adhesion, smoothability, Others, resin, an inorganic particle in order to improve ductility, processing suitability, shock resistance, etc., Although what blended a proper quantity of organic particles, a plasticizer, a compatibilizer, colorant, antioxidants, sprays for preventing static electricity, etc. can be used and the transparency in particular is not limited, when using it as a transparent gas barrier film, a thing with transmissivity of not less than 50% is preferred.

[0010]It is better for a kind of lubricant particle and optimization of an addition to become important in order to reconcile smoothability, processing suitability, and transparency, and for a number PCC value of projections and the three-dimensional surface roughness SRa per unit area in a longitudinal plane of symmetry of granularity to fill a relation of PCC value >=20000 xSRa. As a lubricant particle to add, for that purpose, silica, a titanium dioxide, talc, Metallic oxides, such as kaolinite, calcium carbonate, calcium phosphate, Inertness particles are illustrated to syndiotactic polystyrene system polymer, such as particles which consist of organic polymer, such as a salt of metal, such as barium sulfate, or cross-linked-poly styrene resin, a bridge construction acrylic resin, silicon resin, and cross linked polyester resin. And although any one sort may be independently used for these lubricant and it may use two or more sorts together, Below 0.01-micrometeror more 3.5 mum of an average particle system of lubricant to be used is preferred, 25% or less has the preferred degree of dispersion of particle diameter (ratio of standard deviation and mean particle diameter), and an addition receives syndiotactic polystyrene system polymer 100 weight % -- 0.005 -- more than weight % -- 2.0 -- it is preferred that below weight % contains -- especially -- 1.0 -- below weight % is preferred. As for shape of a lubricant particle, it is preferred to a running characteristic that the above one or more kinds of things are contained for an area profile coefficient 60%.

[0011]Extension methods, such as length, width and the vertical extending method, width, length and the vertical extending method, length, length, a lateral orientation method besides [which performs a publicly known method for example, vertical extension, and lateral orientation in order] a serial biaxial-stretching method, can be used for a syndiotactic polystyrene system film of this invention. A hot heat-resistant outstanding film may be required of a syndiotactic polystyrene system film in this invention. It is preferred that a heat shrinkage rate in 150 ** is 3% or less as this heat resistance. In that case, in order for conditions of extension other than selection of these extension methods to influence greatly and to consider it as outstanding heat resistance, it is preferred to perform heat setting processing, vertical relaxation processing, horizontal relaxation processing, etc.

[0012]Unless a plastic film of this invention spoils the purpose of this invention, it may precede for laminating a thin film layer, and corona discharge treatment, glow discharge processing, and other surface surface roughening processes may be performed for this film, and publicly known anchor coat treatment, printing, and an ornament may be given. The range of 5 - 500 mum is desirable still more preferred as the thickness, and a plastic film of this invention is the range of 8 - 300 mum.

[0013]It is thought that an aluminum oxide and a silicon oxide thin film consist of a mixture of an aluminum oxide and silicon oxide or a compound. It consists of a mixture of various aluminum oxides of aluminum, AlO, aluminum$_2$O, etc., and each content within an aluminum oxide differs from an aluminum oxide here by creation conditions. It is thought that it consists of Si, SiO, SiO_2, etc., and these ratios also differ from oxidized silicon by creation conditions. As a ratio of an aluminum oxide of this thin film in this invention, it is 20 % of the weight or more and 99 % of the weight or less, and they are 30 % of the weight or more and 95 % of the weight or less preferably. a little (as opposed to all the ingredients -- at most -- up to 3 %) other ingredients may also be included in this ingredient in the range by which the characteristic is not spoiled. Especially as thickness of this thin film, although this is not limited, from a point of gas barrier property and ******, 50-8000 A is 70-5000A desirable still more preferably.

[0014]PVD (physical vapor deposition), such as a vacuum deposition method, a sputtering technique, and ion plating, or a CVD method (chemical vapor deposition) is suitably used for creation of this aluminum oxide and silicon oxide system thin film. For example, in a vacuum deposition method, a mixture of aluminum$_2$$O_3$, SiO_2, or aluminum and SiO_2, etc. are used as a deposition source material, and resistance heating, high-frequency induction heating, an electron beam heating, etc. can be used as a heating method. As reactive gas, oxygen, nitrogen, a steam, etc. may be introduced or reactive deposition which used means, such as ozone addition and ion assistance, may be used. moreover -- adding bias etc. to a substrate **** -- substrate temperature -- a rise -- or -- cool **** -- etc. -- unless the purpose of this invention is spoiled -- in -- creation conditions may be changed. It is the same by other creating methods, such as a sputtering technique and a CVD method.

[0015]Although this invention article remains as it is and may be used, a film of other organic high polymers or a thin layer may be used for it, laminating or coating.

[0016]Specific gravity as used in the field of this invention is a certain temperature, and means a ratio of mass of a substance which occupies a certain volume, and it and mass (water at 4 **) of a standard substance of the volume. Although measurement of specific gravity usually measures objective mass and volume and should just calculate a ratio with mass of the 4 ** water of the volume, in measurement of a thin film of this invention, measurement of volume is difficult for it. Then, after changing into a state of a single film which strips a thin film from a substrate first, or consists only of thin films by dissolving only a substrate, it is desirable to use hydrometry which is in (JIS K7112). For example, in the rising-and-falling method, the dipping of the sample can be carried out into a solution of specific gravity known, and specific gravity of a thin film can be measured from the ups-and-downs state. As this solution, mixed liquor, such as a carbon tetrachloride, bromoform, or methylene iodide, can be used. A value of specific gravity can be measured also with a density gradient tube method which makes a single film dip into a solution with a continuous density gradient.

[0017]Thus, when a value of specific gravity of this obtained thin film shows a relation with weight % of an

aluminum oxide in a thin film by a formula called D=0.01 A+b (D: specific gravity of a thin film, weight [of an aluminum oxide in A:thin film] %), At the time of a field where a value of b is smaller than 1.6, structure of an aluminum oxide and a silicon oxide thin film becomes coarse, and sufficient gas barrier property is not obtained. Although the initial gas barrier characteristic after membrane formation excels [value / b] in a value of specific gravity of this thin film in the case of a larger field than 2.2, a film becomes hard too much, a mechanical characteristic, especially the GERUBO characteristic are inferior, and a fall of gas barrier property after processing becomes large, and is not suitable for use as a gas barrier film. Specific gravity of an aluminum oxide and a silicon oxide thin film desirable as a gas barrier film from the above reason, When relation between specific gravity of this thin film and aluminum oxide composition ratio in a thin film is expressed with an expression of relations called D=0.01 A+b (D: specific gravity of a thin film, weight [of an aluminum oxide in A:thin film] %), in a value of b, it is 1.6 to 2.2 and is 1.7 to 2.1 still more preferably.

[0018]

[Example]Although an example explains this invention concretely below, this invention is not limited only to these examples. How to measure the characteristic of the polystyrene system transparent gas barrier film created by the example and the comparative example below and the inert particle used is shown.

[0019](1) Contraction of the film [/ in 30 minutes in atmosphere of 150 **] was searched for in the state of the heat shrinkage rate non-tension in 150 **.

[0020](2) A three-dimensional surface roughness SRa film surface at the longitudinal direction of a film using a sensing pin type three-dimensional surface roughness meter (SE-3AK, Kosaka Laboratory [, Ltd.], Ltd. make) to conditioning of 2 micrometers in radius of a needle, and 30 mg of load by the cutoff value of 0.25 mm. It measures over the measurement length of 1 mm, and is 500 at a 2-micrometer pitch. It divided into the point and the height of each point was made to incorporate into a three-dimensional granularity analysis device (SPA-11). It is the same operation as this continuously [at intervals of 2 micrometers] about the cross direction of a film 150 It carried out over 0.3 mm of cross direction of a time, i.e., a film, and data was made to incorporate into an analysis device. Next, SRa was calculated using the analysis device.

[0021](4) What expressed the number of projections which has the height more than 0.00625 mum from the base level which has the reference height at the time of calculation of the PCC value SRa about per 1-mm^2.

[0022](4) A mean-particle-diameter lubricant particle is observed with the Hitachi type S-510 scanning electron microscope, expand and copy that a photograph of was taken, trace the outside of lubricant, and it is 200 arbitrarily. The particles of the individual were smeared away black. It is Nicolet roux ZEKKUSU 500 about this image. Using the type image analyzing device, horizontal Ferre of each particle was measured and that average value was made into mean particle diameter. The degree of dispersion of particle diameter was computed by the following formula.

dispersion degree =(standard deviation/mean particle diameter of particle diameter) x 100 (%)

[0023](5) The projected cross section product of each particle was measured using the image analyzing device which chose 20 particles from the trace image used for measurement of area profile coefficient mean particle diameter arbitrarily, and was used by (4). The area of the circle circumscribed to those

particles was computed, and it computed by the following formula.
Area profile coefficient =(area of circle circumscribed to projected cross section product / particles of particles) x 100 (%) [0024](6) The oxygen permeability of the gas barrier film in which oxygen permeability carried out measuring method creation was measured using the oxygen transmission rate measurement system (OX-TRAN100 by modern conte RORUZU).
[0025]
(7) The test method bending-fatigue-resistance nature of bending-fatigue-resistance nature (henceforth, GERUBO characteristic) was evaluated using what is called a Gelboflex tester (made by Physical science Industrial company). As conditions, a test piece (11.2 inches x 8 inches) is made cylindrical [diameter 3 (1/2)inch] by (MIL-B131 H), both ends are held, and it is considered as the initial grasping interval of 7 inches, and is 3(1/2)inch of a stroke, 400 A twist of a degree is added and repetition reciprocating movement of this operation was performed under 20 ** and the conditions of 65% of relative humidity with the speed of 40 times / min.
[0026](Example 1) As lubricant, mean-particle-diameter 1.0 mum and 20% of the degree of dispersion, It is calcium carbonate of 80% of an area profile coefficient to syndiotactic polystyrene (weight average molecular weight 300000) 100 weight % 1.0 Weight % addition The polymer chip carried out, After mixing the polymer chip with which lubricant is not added at a rate of 0.5 opposite 9.5 by a weight ratio, It dried, fused by 310 **, and extruded from the T die of the lip gap of 800 mum, adhesion and cooling solidification made it a 50 ** cooling roller by the electrostatic **** method, and the formless sheet of 135 mum was obtained.
[0027]Preheat this formless sheet at 95 ** by the SERAMMI crawl first, and it heats to 138 ** with a silicon rubber roll, It is 3.5 to a lengthwise direction. Double-extend and, subsequently vertical relaxation processing is carried out 20% between the ceramics roll of 120 **, and a 40 ** metallic roll, preheating a film at 120 ** by a tenter -- a transverse direction -- extension temperature 120 **1.8 -- double-extending -- 180 ** -- a transverse direction -- 1.9 -- it double-extended and heat setting processing was carried out for 12 seconds by 250 **. Then, horizontal relaxation processing was carried out 3% by 215 **, and also vertical relaxation processing was carried out 2% by 210 **. The thickness of the obtained film was 14 micrometers. 150 The heat shrinkage rate in ** was 2.5 %.
[0028]As a deposition source, aluminum$_2O_3$ (99.5% of purity) and SiO_2 (99.9% of purity) of particle state of the size about 3 - 5 mm were used for the obtained film, and the aluminum oxide silicon oxide thin film was formed in it with electron beam evaporation method. Without mixing, the deposition material divided the inside of Haas with the carbon plate into 2 **, and heated each of aluminum$_2O_3$ and SiO_2 by time sharing, using one set (henceforth, EB gun) of an electron gun as a source of heating. Changing the emission current of EB gun at that time with 0.8 - 2.2 A, the heating ratio to aluminum$_2O_3$ and SiO_2 changed with 20:10-50:10, and changed the presentation. Film advance speed was changed with 30 - 120 m/min, and made the film of 500-5000A thickness. Steam pressure is changing the amount of supply of oxygen gas etc., and changed conditions to $1x10^{-5}$ - $8x10^{-3}$Torr.
[0029]Since the humidity expansion coefficient of the obtained film indicates a very low numerical value to be $5x10^{-7}$/%RH and coefficients of thermal expansion are also $2x10^{-5}$/ ** and a good value, It excels in

the dimensional stability by the environmental variation at the time of processing after thin film layer formation, and use, and fault generating of the exfoliation of a thin film layer based on an environmental variation, a crack, camber, flapping, etc. did not arise. Thus, the specific gravity of the obtained film was measured by the rising-and-falling method, after dissolving syndiotactic polystyrene films.

[0030]As opposed to the bipolar membrane on this syndiotactic polystyrene, dry laminate of the 40-micrometer-thick non-stretched polypropylene film (OPP film) was carried out using 2 liquid hardening type polyurethane adhesive (2 micrometers in thickness), and the plastic film for a package of this invention application was obtained. After performing retorting (120 degree x 30 minutes) or GERUBO processing to this film for a package, oxygen barrier property was measured.

[0031]Thus, the measured oxygen permeability was dramatically as excellent as 1.0 cc order. It is 200 to a pan. The result after a time GERUBO examination also stopped at the rise of around 2-3 cc, and the gas barrier film which was excellent in the overall characteristic was obtained. (Tables 1 and 2)

[0032](Comparative example 1) The oxygen barrier property after measurement of specific gravity and retorting, or GERUBO processing was measured to the sample obtained by EB vacuum evaporation like Example 1 by creating an aluminum oxide silicon oxide system transparent gas barrier thin film. As a result, it became what has either [insufficient] oxygen barrier property, retort-proof nature or the GERUBO characteristic, and became poor by the comprehensive judgment. (Tables 1 and 2)

[0033](Comparative example 2) The aluminum oxide silicon oxide system transparent gas barrier thin film was created by EB vacuum evaporation like Example 1 except having used the polyethylene terephthalate film (Toyobo Co., Ltd.: E5007) instead of syndiotactic polystyrene films. Thus, the specific gravity of the obtained film was measured by the rising-and-falling method, after dissolving syndiotactic polystyrene films. As a result, although it was enough about oxygen barrier property, retort-proof nature, or the GERUBO characteristic, Since the humidity expansion coefficient of the used polyethylene terephthalate film is 120 x10 $^{-7}$/%RH and its humidity expansion is large as compared with syndiotactic polystyrene films, Camber occurred on the film by the humidity and retorting at the time of processing after thin film layer formation, and use, and it became poor by the comprehensive judgment.

[0034](Comparative example 3) As opposed to the sample obtained by creating an aluminum oxide silicon oxide system transparent gas barrier thin film by EB vacuum evaporation like Example 1 except having used the polyamide film (Toyobo Co., Ltd.: N1100) instead of syndiotactic polystyrene films, The oxygen barrier property after measurement of specific gravity and retorting, or GERUBO processing was measured. As a result, although it was enough about oxygen barrier property, retort-proof nature, or the GERUBO characteristic, Since the humidity expansion coefficient of the used polyamide film is 1000x10 $^{-7}$/%RH and its humidity expansion is very large as compared with syndiotactic polystyrene films, Curl occurred on the film by the humidity and retorting at the time of processing after thin film layer formation, and use, and it became poor by the comprehensive judgment.

[0035]

[Effect of the Invention]In the gas barrier film in which the aluminum oxide and the silicon oxide system thin film were formed on the film which consists of a resin composition containing the polystyrene system polymer which has syndiotactic structure, The ratio of the aluminum oxide in this thin film is 99 or less % of the weight of 20 % of the weight or more, When the relation between the specific gravity of this thin film

and the aluminum oxide composition ratio in a thin film is expressed with an expression of relations called D=0.01 A+b (D: specific gravity of a thin film, weight [of the aluminum oxide in A:thin film] %), By carrying out the specific gravity of this thin film within the limits expressed with 1.6<=b<=2.2, it excels in gas barrier property, and the aluminum oxide and oxidized silicon system gas barrier film with high retort-proof nature and flexibility which was synthetically excellent in the practical use characteristic can be provided.

[0036]

[Table 1]

	加熱比		EB銃のエミッション電流(A)	フィルム送り速度 (m/min)	真空時の真空圧 (Torr)
	Al_2O_3	SiO_2			
実施例1-1	30	10	2.0	50	8.5×10^{-4}
実施例1-2	40	10	2.0	50	8.8×10^{-4}
実施例1-3	50	10	2.0	50	9.2×10^{-4}
実施例1-4	60	10	2.0	50	9.4×10^{-4}
実施例1-5	70	10	2.0	50	9.6×10^{-4}
比較例1	10	10	2.0	50	8.0×10^{-4}

酸素流量；130CCM

チルロール冷却温度；-10℃

[0037]

[Table 2]

	比重	組成 Al_2O_3 (%)	組成 SiO_2 (%)	膜厚 (A)	O_2バリア cc/m²・24h atm	レトルト後 cc/m²・24h atm	ゲルボ特性 cc/m²・24h atm	総合判定
実施例1-1	2.24	35	65	800	0.4	0.5	1.0	○
実施例1-2	2.36	47	53	800	0.4	0.5	1.0	○
実施例1-3	2.52	57	43	800	0.4	0.5	1.0	○
実施例1-4	2.58	65	35	800	0.5	0.6	0.9	○
実施例1-5	2.71	75	25	800	0.5	0.6	0.9	○
比較例1	2.04	15	85	800	1.0	30	1.5	×

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1]In a gas barrier property film by which an aluminum oxide and a silicon oxide thin film were formed on a film which consists of a resin composition containing a polystyrene system polymer which has syndiotactic structure, A lamination polystyrene system film, wherein ratios of an aluminum oxide are 20 % of the weight or more and 99 % of the weight or less and specific gravity of this thin film satisfies a following formula in this thin film.
D=0.01 A+b -- however -- D: -- weight %1.6 <=b<=2.2 of specific gravity of a thin film, and an aluminum oxide in A:thin film

[Translation done.]